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**EFFECT OF FUEL HEAD AT CARBURETOR, ON BRAKE
HORSEPOWER AND BRAKE SPECIFIC
FUEL CONSUMPTION**

(POWER PLANT SECTION REPORT)



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EFFECT OF FUEL HEAD AT CARBURETOR, ON BRAKE HORSEPOWER AND BRAKE SPECIFIC FUEL CONSUMPTION.

OBJECT.

To determine the relation between fuel head at the carburetor and the horsepower and fuel consumption of an engine, and to determine the maximum and minimum practicable heads for several types of service carburetors.

SUMMARY OF RESULTS.

The effect on the horsepower and fuel consumption of an engine of increasing the fuel head at the carburetor may be summarized as follows:

STROMBERG NA-D6 CARBURETOR.

Minimum operating head, 12 inches of gasoline.¹

Horsepower remains practically constant between minimum head and static flooding point with a slight increase in fuel consumption with increased head.

Does not flood at 8 pounds per square inch pressure.

PACKARD ZENITH U. S. 54 CARBURETOR.

Minimum operating head, 6.3 inches of gasoline.

Horsepower remains practically constant between minimum head and static flooding point with a slight increase in fuel consumption up to a head of 2 pounds per square inch and a more marked increase between heads of 2 and 4 pounds per square inch.

Does not flood at head of 8 pounds per square inch.

ZENITH U. S. 52 CARBURETOR (LIBERTY).

Minimum operating head, 40 inches of gasoline.

Marked increase in horsepower from 8 to 40 inch heads.

Horsepower practically constant between heads of 2 pounds per square inch and 8 pounds per square inch.

Fuel consumption in general increases with carburetor head.

Does not flood at 8 pounds per square inch pressure.

STROMBERG NA-L5 CARBURETOR.

Minimum operating head, 12 inches of gasoline.

Horsepower and fuel consumption practically constant between heads of 12 inches of gasoline and 5 pounds per square inch pressure.

Floods at head of 4.4 pounds per square inch pressure.

METHOD OF TEST.

Tests were conducted on the model "H" Hispano-Suiza engine equipped with a Stromberg NA-D6 carburetor, the model 1A-1237 Packard engine fitted with the Packard Zenith U. S. 54 carburetor, the Liberty "12" engine fitted with the Stromberg NA-L5 (inverted) carburetor, and the Liberty "12" with the Zenith U. S. 52 carburetor. The engines were coupled to an electric cradle dynamometer and tested at normal speed full throttle for horsepower and fuel consumption with varying fuel heads.

¹ The "minimum operating head" is the lowest head giving normal operation at full throttle, normal speed.

The apparatus for varying the fuel head at the carburetor consists of a portable fuel tank, mounted on scales, with an air line connection for controlling the pressure on the fuel in the tank. The head at the carburetor was measured with a mercury manometer connected to the fuel line. The gasoline level in the float chamber was observed by means of a sight gauge which was vented back to the top of the float chamber.

The flooding point was determined on several carburetors of each model before the engine was started by increasing the fuel head until gasoline overflowed from the jets. The engine was then run at the normal speed, full throttle, and the minimum head determined which would give regular operation. Further runs were then made varying the head of gasoline between the minimum head and the static flooding point. Since the change of engine performance between the limits in the tests was confined mainly to the vicinity of the minimum head, small increments of change in the gasoline head were taken about that point and large increments taken over the main part as shown by the curves, figures 1 to 4.

The Stromberg NA-D6 on the model "H" Hispano-Suiza and the Packard Zenith and the U. S. 54 on the Packard 1A-1237 were tested taking a comparatively large number of readings, but the tests in general conformed to the above description.

All runs were made with the mixture control in the full rich position.

All standard power and fuel consumption readings, as outlined in Engineering Division report, serial No. 1507, were taken at each pressure increment.

RESULTS OF TEST.

The results of the test are shown in the curves, figures 1, 2, 3, and 4, and the data tables, page 4. It will be noted that the Zenith U. S. 52 carburetor is more sensitive to changes in fuel head than the other three carburetors tested, especially between 8 inches and 40 inches head of gasoline. The horsepower increase throughout this range was approximately 4 per cent, and the fuel consumption increase was 10 per cent. Forty inches was, therefore, taken as the minimum head, although the engine would operate at lower heads with some loss in power. The fuel head change had only slight effect on the horsepower output of the engines equipped with the Stromberg NA-D6, Packard-Zenith, and the Stromberg NA-L5 carburetors producing a maximum variation of approximately 1 per cent in the case of the Stromberg NA-L5 carburetor. An increase in fuel head caused a slight increase in fuel consumption of the engines equipped with the Stromberg NA-D6 and the Packard-Zenith and a very slight decrease in the fuel consumption with the Stromberg NA-L5.

It is recommended that these carburetors be operated with gasoline pressures safely above the minimum values given under "Summary of Results."

Model "H" Hispano-Suiza engine, Stromberg NA-D6 carburetor.

Fuel head.		Corrected horse-power at 1,800 R. P. M.	Carburetor air, temperature °F.	Fuel consumption.	
Gasoline (inches).	Pressure, pounds per square inch.			Pounds per hour.	Pounds per horse-power hour.
6.0	0.15	319.5	79	193.0	0.621
12.0	.30	318.0	82	204.0	.667
18.0	.45	319.2	81	206.1	.670
24.0	.60	317.5	81	206.0	.665
30.0	.75	317.5	84	203.0	.663
36.0	.90	319.5	86	202.9	.656
48.0	1.20	318.6	88	203.5	.663
60.0	1.50	316.0	89	205.4	.680
79.6	2.00	318.7	83	206.1	.671
99.4	2.50	319.7	80	204.0	.659
119.4	3.00	318.5	81	205.9	.670
139.5	3.50	319.0	74	207.1	.677
159.4	4.00	316.9	79	207.1	.675
179.2	4.50	318.6	78	207.0	.675
199.0	5.00	315.0	83	208.2	.684
239.0	6.00	316.0	84	209.4	.686
278.8	7.00	315.1	87	204.2	.673
318.2	8.00	317.5	79	208.9	.682

Packard 1A-1237 engine with Packard-Zenith, U. S. 54 carburetor.

Fuel head.		Horse-power corrected to 1,800 R. P. M. and 29.92 In. Hg., average.	Carburetor air, temperature °F.	Average fuel consumption.	
Gasoline (inches).	Pressure, pounds per square inch.			Pounds per hour.	Pounds per horse-power hour.
6.3	0.157	352.1	84	180.2	0.526
12.2	.304	351.9	84	176.5	.520
18.0	.451	351.8	84	177.7	.520
24.3	.608	352.8	85	172.5	.507
30.2	.754	352.8	86	177.9	.529
36.1	.902	353.3	86	178.7	.523
48.4	1.21	352.5	88	178.2	.524
60.4	1.51	352.8	88	179.5	.527
80.0	2.00	351.7	86	178.8	.528
100.0	2.50	352.8	86	181.8	.539
120.0	3.00	351.8	87	182.4	.539
140.0	3.50	348.8	88	180.5	.537
160.0	4.00	349.2	88	183.8	.548
180.0	4.50	355.5	76	184.6	.531
200.0	5.00	356.5	78	182.7	.529
240.0	6.00	357.3	78	187.7	.544
280.0	7.00	355.3	78	188.5	.542
320.0	8.00	355.8	79	184.6	.534

Liberty 12 engine, Stromberg NA-L5 carburetor.

Fuel head.		Corrected horse-power at 1,700 R. P. M.	Carburetor air, temperature °F.	Fuel consumption.	
Gasoline (inches).	Pressure, pounds per square inch.			Pounds per hour.	Pounds per horse-power hour.
3.9	0.098	356.2	82	162.2	0.474
7.8	.196	417.5	82	189.4	.484
7.8	.196	422.0	82	189.6	.480
135.2	3.38	422.5	82	193.5	.499
256.8	6.42	422.5	82	191.5	.484
262.9	6.57	425.0	82	191.5	.484
376.4	9.41	425.5	82	192.5	.488
378.4	9.46	421.0	80	191.5	.468

Liberty 12 engine with Zenith U. S. 52 carburetor.

Fuel head.		Horse-power corrected to 1,700 R. P. M. and 29.92 In. Hg. average.	Carburetor air, temperature °F.	Fuel consumption.	
Gasoline (inches).	Pressure, pounds per square inch.			Pounds per hour average.	Pounds per horse-power hour average.
5.9	0.147	370.3	90	184.3	0.507
5.9	.147		92		
5.9	.147		92		
13.7	.343	392.5	90	204.3	.532
13.7	.343		90		
21.5	.539	394.9	91	207.2	.537
21.5	.539		94		
84.4	2.11	393.8	94	213.9	.552
84.4	2.11		92		
154.8	3.87	389.7	93	212.8	.556
154.8	3.87		93		
241.2	6.03	391.2	93	219.6	.572
237.2	5.93		94		
311.6	7.79	389.4	91	222.5	.585
311.6	7.79		92		

Carburetor settings.

	Choke.	Main jet.	Comp. jet.
Stromberg NA-D6.....	1-13/16 in....	No. 32 drill..	2.15 mm.
Packard-Zenith U. S. 54.....	36 mm.....	2.10 mm.....	
Stromberg NA-L5 (single Venturi).	1-5/8 in.....	No. 42 drill..	
Zenith U. S. 52.....	36 mm.....	1.65 mm.....	1.70 mm.

NOTE.- The mixture control was set in the full rich position for all runs.

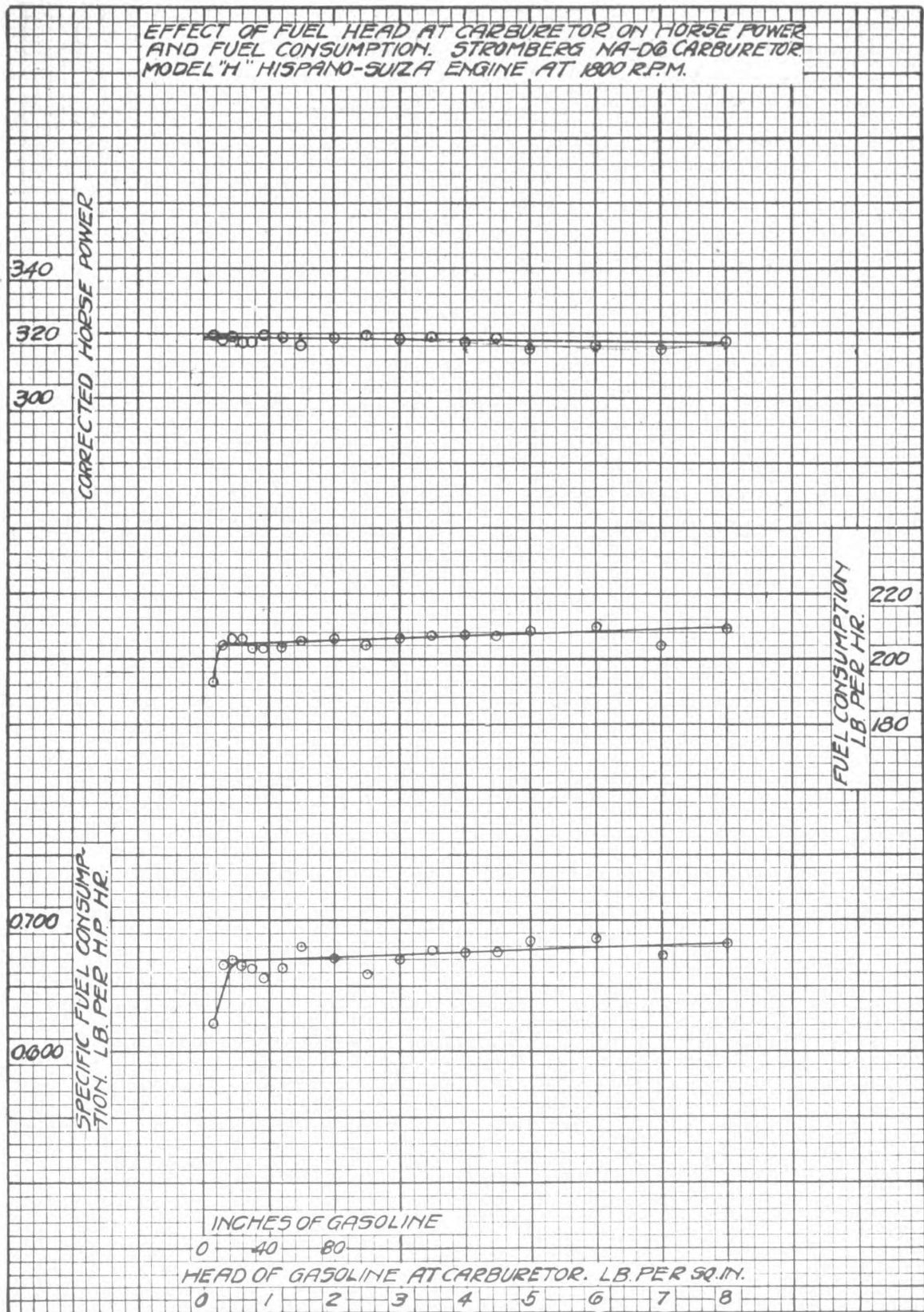


FIG. 1.

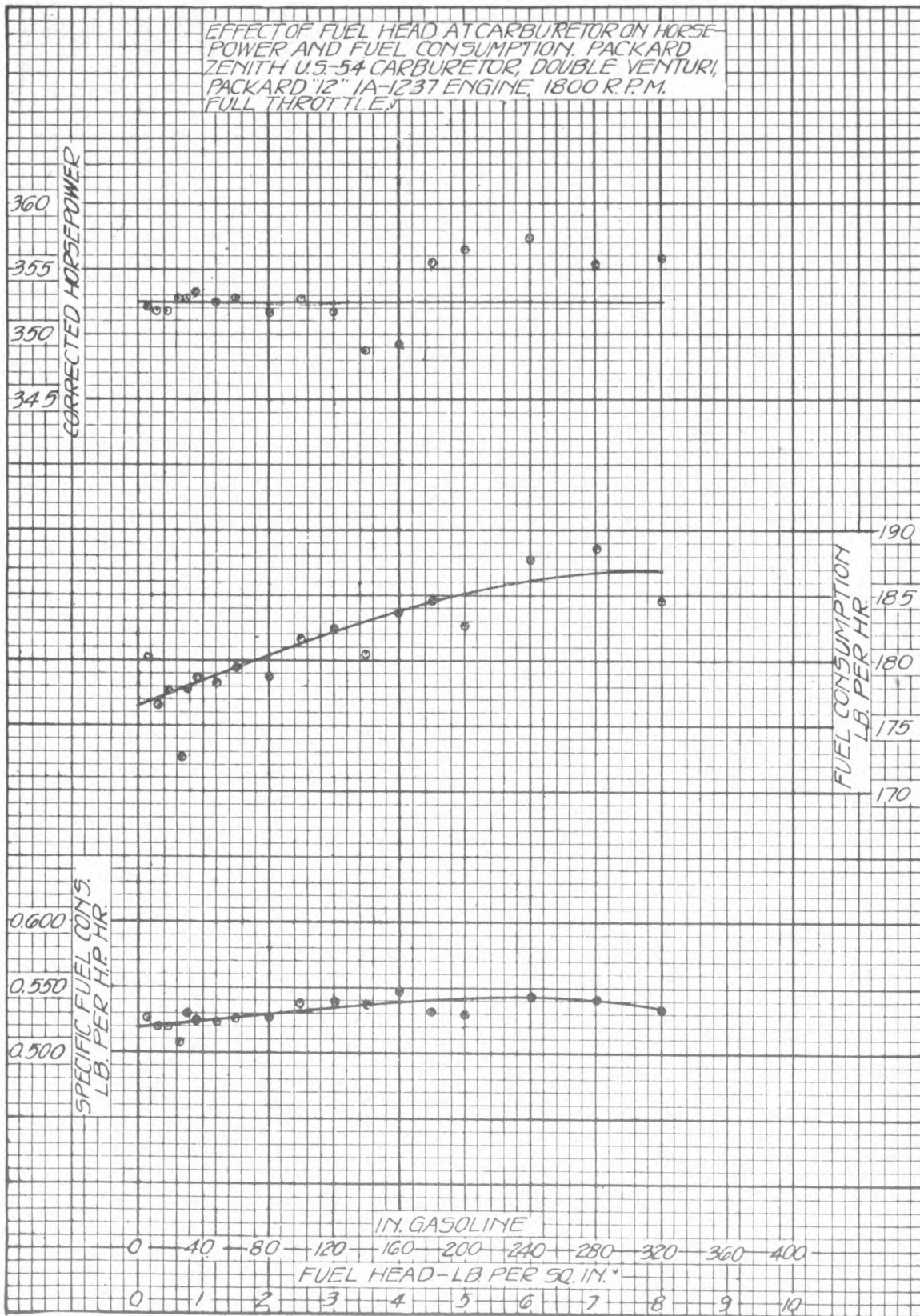


FIG. 2.

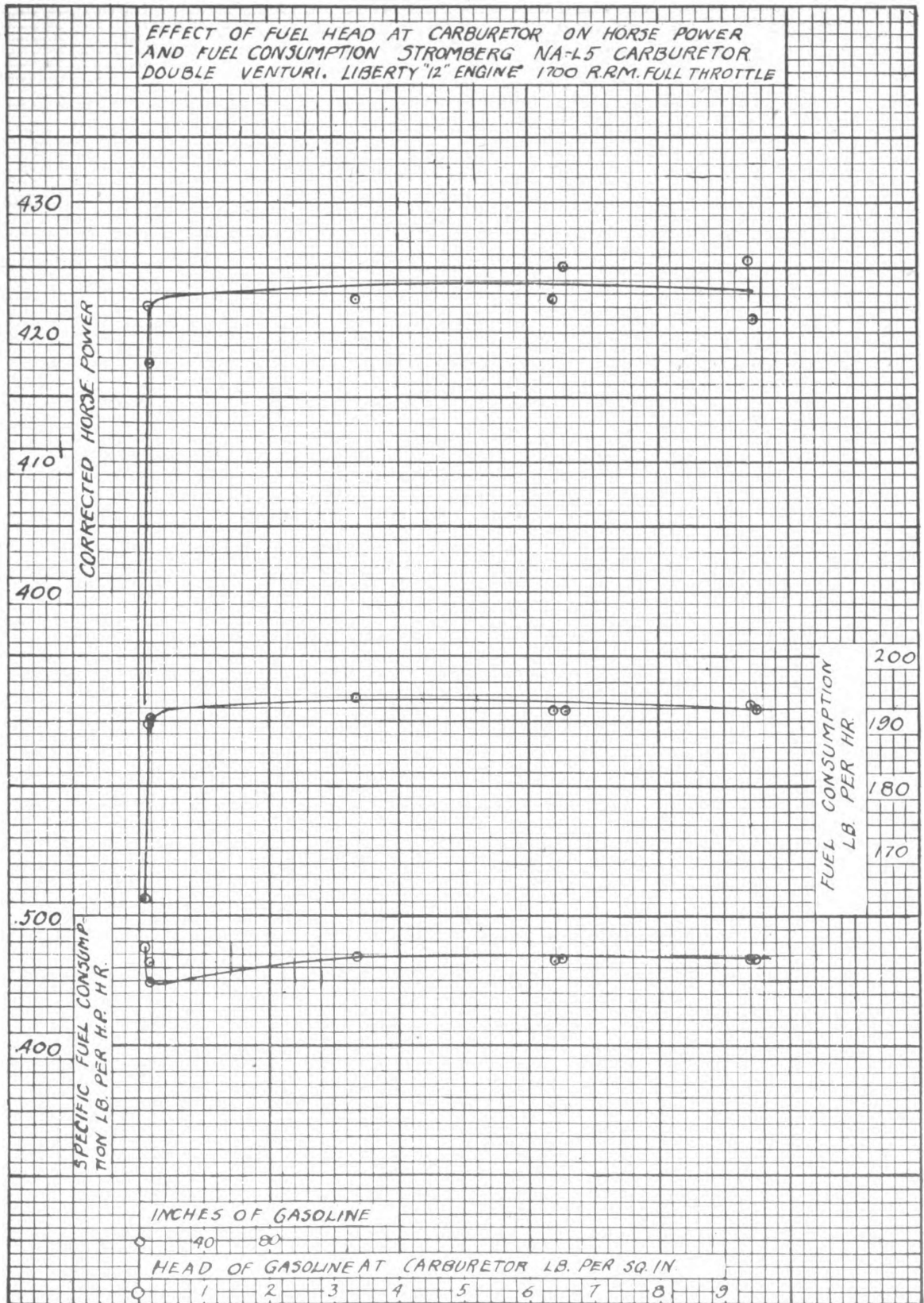


FIG. 3.

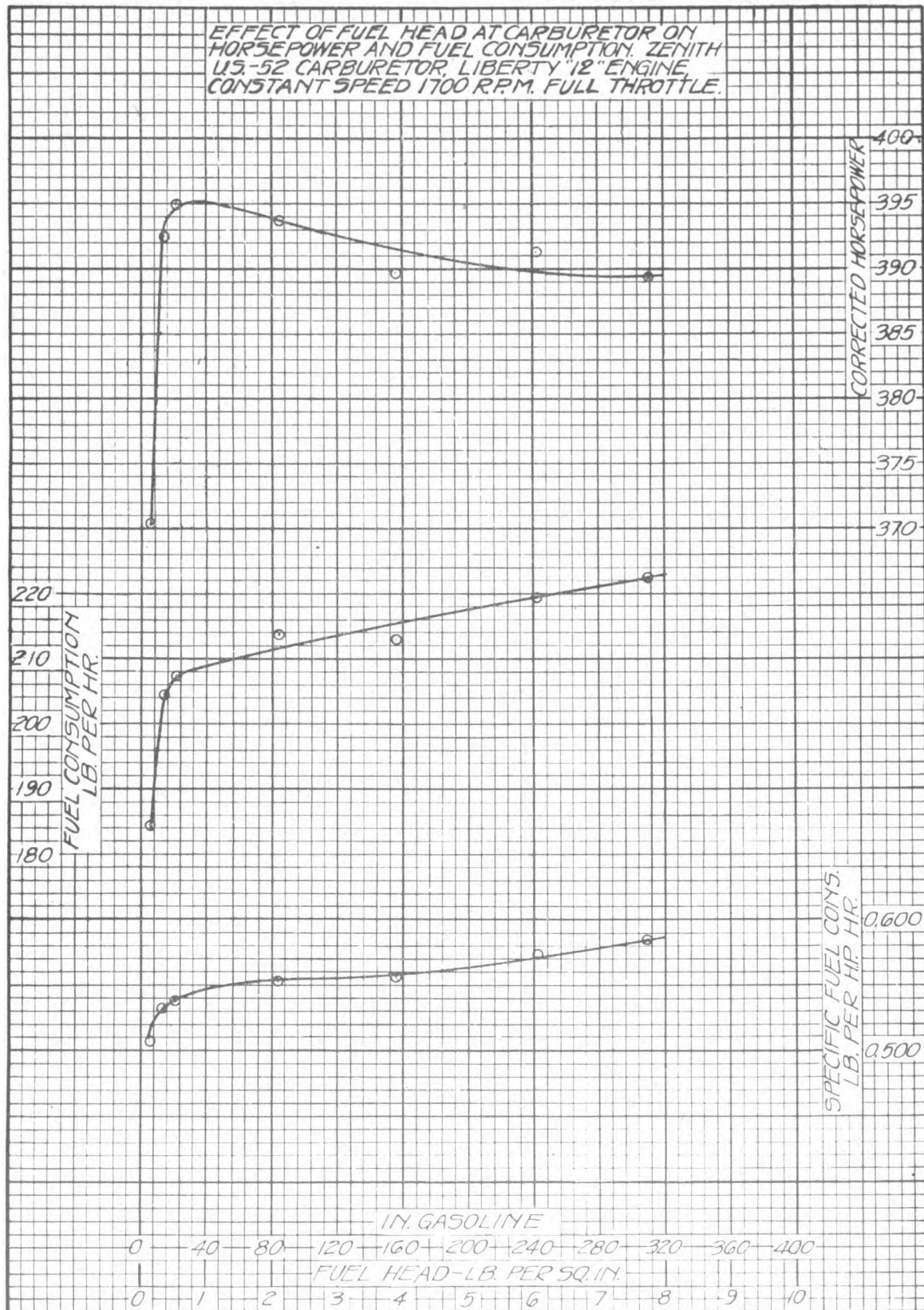


FIG. 4.